2.

Fig. 7A through Fig. 7C illustrate processes in a method of manufacturing a semiconductor device in accordance with an exemplary embodiment 3 of the invention.

Fig. 8A through Fig. 8D illustrate processes in the method of manufacturing the semiconductor device in accordance with the embodiment 3.

Fig. 9A and Fig 9B illustrate processes of mounting the semiconductor device in accordance with the embodiment 3.

Fig. 10A through Fig. 10D illustrate processes in a method of manufacturing a semiconductor device in accordance with an exemplary embodiment 4 of the invention.

Fig. 11A through Fig. 11C illustrate processes in the method of manufacturing the semiconductor device in accordance with the embodiment 4.

Fig. 12 is a perspective view of the semiconductor device in accordance with the embodiment 4.

Fig. 13A through Fig. 13C illustrate processes of mounting the semiconductor device in accordance with the embodiment 4.

Fig. 14A through Fig. 14D illustrate processes in a method of manufacturing a semiconductor device in accordance with an exemplary embodiment 5 of the invention.

Fig. 15A through Fig. 15D illustrate processes in the method of manufacturing the semiconductor device in accordance with the embodiment 5.

Fig. 16A through Fig. 16C illustrate processes in a method of manufacturing a semiconductor device in accordance with an exemplary

embodiment 6 of the invention.

Fig. 17A through Fig. 17D illustrate processes in the method of manufacturing the semiconductor device in accordance with the embodiment 6.

Fig. 18A and Fig. 18B illustrate processes of mounting the semiconductor device in accordance with the embodiment 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Exemplary Embodiment 1)

Fig. 1A through Fig. 1D and Fig. 2A through Fig. 2C illustrate processes in a method of manufacturing a semiconductor device in accordance with an exemplary embodiment 1. Fig. 3 is a perspective view of the semiconductor device, and Fig. 4A through Fig. 4C illustrate processes of mounting the device. Fig. 1A through Fig. 1D and Fig. 2A through Fig. 2C illustrate the method of manufacturing the semiconductor device in order of procedure of the method.

In Fig. 1A, bumps 2, electrodes for external connections, are formed on a top surface of a semiconductor wafer 1 in which plural semiconductor elements are formed. As shown in Fig. 1B, a sheet 3 is attached to a bump-formed surface (electrode-formed surface), which is the top surface of the wafer 1, and then, the wafer 1 has a back surface opposite the electrode-formed surface thinned while being reinforced with the sheet 3. The back surface is thinned by shaving with a polishing machine having a grinding wheel, by etching with a dry etching apparatus, or by etching with utilizing a chemical reaction of a chemical solution. The wafer 1 is thus thinned to have a thickness of about 50μm.

Subsequently, a bumper plate 4 is stuck to the back surface of the thinned semiconductor wafer 1. As shown in Fig. 1C, an adhesive 5 is applied

to a top surface of a bumper plate 4 formed by shaping a material such as resin, ceramic, metal or the like into a plate. The adhesive 5 is a resin adhesive having a low elastic modulus, and is made of material such as elastomer having a low elastic modulus in bonding for being easily expanded and contracted with a small external force.

The bumper plate 4 functions as a holding member in handling of the semiconductor device after the semiconductor elements are separated from one another to form the semiconductor devices, respectively, and also functions as a reinforcing member to protect the semiconductor elements from an external force and impact. Accordingly, the bumper plate 4 has an enough thickness to exhibit a greater flexural rigidity than the semiconductor element. After the bumper plate 4 is attached to the wafer 1, as shown in Fig. 1D, a holding sheet 6 used in a dicing process is attached to an undersurface of the bumper plate 4, and then the sheet 3 is peeled from the electrode-formed surface.

The bumper plate 4 and semiconductor wafer 1 both held by the sheet 6 are processed in the dicing process. In the process shown in Fig. 2A, a two-stage dicing is performed to cut the bumper plate 4 and wafer 1 along different dicing widths, respectively. Specifically, the wafer 1 is cut with a dicing width b1 to be divided into discrete semiconductor elements 1', while the bumper plate 4 is cut with a dicing width b2 narrower than the width b1 to be divided into discrete bumper members 4'.

Then, the sheet 6 is peeled from bumper members 4' which are bonded to respective semiconductor elements 1' with the adhesive 5, and thus, discrete semiconductor devices 7, one of which is shown in Fig. 2B, is provided. Each semiconductor device 7 includes the semiconductor element 1' having bumps 2 functioning as electrodes for external connections, and bumper member 4'